

**2026 11th International Conference on Cloud
Computing and Internet of Things (CCIOT 2026)**

**2026 8th International Conference on Software
Engineering and Development (ICSED 2026)**

October 24-26, 2026

University of the Ryukyus, Okinawa, Japan

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Welcome Message

On behalf of the organizing committee, we feel greatly honored and pleased to welcome you to 2026 11th International Conference on Cloud Computing and Internet of Things (CCIOT 2026) and 2026 8th International Conference on Software Engineering and Development (ICSED 2026), which will take place in Okinawa, Japan from October 24 to 26, 2026.

CCIOT 2026 and ICSED 2026 gather top experts, researchers and practitioners worldwide to share frontier advancements, creative ideas and collaborative insights in Cloud Computing and Internet of Things, along with Software Engineering and Development. It acts as a top-tier platform for promoting interdisciplinary discussions, exploring new technologies and tackling challenges and opportunities in these fast-evolving fields.

We are delighted to host this event at the prestigious University of the Ryukyus, a hub of academic excellence and innovation.

Over the course of three days, you will have the opportunity to engage in keynote speeches, Invited Speeches, technical sessions, all designed to facilitate knowledge exchange and collaboration. We are confident that the varied perspectives and expertise here will foster meaningful discussions and groundbreaking outcomes.

On behalf of all the conference committees, we wish to thank all authors, along with technical program committee members and reviewers. Their strong competence, enthusiasm, time and professional expertise allowed us to prepare the high-quality final program and helped make the conference a successful event.

We wish you a productive, inspiring, and enjoyable conference experience. Welcome to CCIOT 2026 and ICSED 2026!

CCIOT 2026 and ICSED 2026 Organizing Committee
October 2026

Conference Committees

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 Morakot Choetkiertikul, Mahidol University, Thailand
 Pakawan Pugsee, Chulalongkorn University, Thailand

Guideline for Onsite Attendance

Important Notes

- Please enter the meeting room at least 15 minutes before your session. Your punctual arrival and active involvement will be highly appreciated.
- Please wear your name tag for all the conference activities. Lending it to others is not allowed. If you have any accompanying person, please do inform our staff in advance.
- Please keep all your belongings (laptop and camera etc.) at any time. The conference organizer does not assume any responsibility for the loss of personal belongings.
- Please show name tag and meal coupons when dining.
- Due to force majeure including but not limited to earthquake, natural disaster, war and country policy, the organizer reserves the rights to change the conference dates or venue with immediate effect and takes no responsibility.

Oral & Poster Presentation

- Regular oral presentation: 15 minutes (including Q&A).
- Get your presentation PPT or PDF files prepared. Presentations MUST be uploaded at the session room at least 15 minutes before the session starts.
- Laptop (with MS-Office & Adobe Reader), projector & screen, laser pointer will be provided in all oral session rooms.
- Poster Presenters should bring your poster to the conference venue and put it on designated place.

Guideline for Online Attendance

Platform: ZOOM

- Step 1: Download ZOOM from the link: <https://zoom.us/download>

How to use ZOOM

* A Zoom account is not required if you join a meeting as a participant, but you cannot change the virtual background or edit the profile picture.

- Rename: Before you enter the conference room, please change your name to Paper ID + Name
- Chat and raise your hand: During the session, if you have any questions, please let us know by clicking “raise your hands” and use “chat” to communicate with conference secretary.
- When you deliver your online speech, please open your camera.
- During the Question section, if you have any questions about keynote speakers or authors, you can also click “raise your hands” or “chat”
- Share Screen: Please open your power point first, and then click “share screen” when it’s your turn to do the presentation.

How to join the conference online

- Find your paper ID and suitable meeting ID on the conference program.
- Open the ZOOM, click the join, paste the meeting ID, then you can join the conference.
- Click the stop share after you finish your presentation

Time Zone

- Japan Standard Time (**GMT+9**)

Device

- A computer with an internet connection (wired connection recommended)
- USB plug-in headset with a microphone (recommended for optimal audio quality)
- Webcam: built-in or USB plug-in

Online Room Information

Online Room Information

Zoom ID: 863 3027 2313

Zoom Link: <https://us02web.zoom.us/j/86330272313>

* Please rename your Zoom Screen Name in below format before entering meeting room.

Role	Format	Example
Conference Committee	Position-Name	Conference Chair-Prof.
Keynote/ Invited Speaker	Position-Name	Keynote/Invited Speaker-Prof.
Author	Session Number-Paper ID-Name	S1-ES0001 Name
Delegate	Delegate-Name	Delegate-Name

Conference Venue

Engineering Building No. 1, Faculty of Engineering, University of the Ryukyus

Address: 1 Senbaru, Nishihara, Okinawa Japan 903-0213



Map for University of the Ryukyus(English):

https://www.u-ryukyu.ac.jp/campus-map_en/

Map for University of the Ryukyus(Japanese):

<https://www.u-ryukyu.ac.jp/campus-map/>

Conference Room

Date	Room
October 24, 2026 (Registration)	PBL Room, 1st Floor, Engineering Building No. 1
October 25, 2026	Ryu-Lab Room, 1st Floor, Engineering Building No. 1 Online Zoom ID: 863 3027 2313

Transportation Methods to University of the Ryukyus

Monorail

Yui Rail: Naha Airport ⇒ Tedako Urashiku (about 40 min), then Taxi (about 10 min)

Express Bus

a. Lines 111, 117 (Ryukyu Bus, Okinawa Bus, Naha Bus, Toyo Bus)

Domestic Terminal ⇒ Ryu Dai Iriguchi (40-50 min)

b. Lines 113, 123, 152 (Ryukyu Bus)

Domestic Terminal ⇒ Ryu Dai Iriguchi (40-50 min)

Shuri Station Express Line

Line 94 (Naha Bus)

Monorail Shuri Station ⇒ University of the Ryukyus (weekdays only)

Regular Bus

a. Line 97 (Naha Bus) ⇒ Ryu Dai

b. Line 98 (Ryukyu Bus) ⇒ Ryu Dai

※ Due to traffic congestion, buses may not run on schedule.

※ Please allow plenty of time when coming to the university.

Simple Program

October 24 , 2026

Onsite Registration

Registration Time: 13:30-16:30
Venue: University of the Ryukyus-Faculty of Engineering
Conference Room: PBL Room, 1st Floor, Engineering Building No. 1
Address: 1 Senbaru, Nishihara, Nakagami District, Okinawa 903-0129, Japan
1. Arrive at the Room, University of the Ryukyus-Faculty of Engineering; 2. Inform the conference staff of your paper ID; 3. Sign your name on the Participants list; 4. Sign your name on Lunch & Dinner requirement list; 5. Check your conference kits; 6. Finish registration.

Online Test

Time Zone: GMT+9

Zoom ID: 863 3027 2313	Duration
Zoom Link: https://us02web.zoom.us/j/86330272313	
Keynote Speaker-Prof. Witold Pedrycz	10:30-10:40
Invited Speaker- Assoc. Prof. Marshima Mohd Rosli	10:40-10:50
Session 3: ES0011,ES0008, ES0013, ES0017, ES1001	10:50-11:30
Session 4: ES5002, ES5023, ES0017, ES5014, ES5009	11:30-12:00

Note: If you are not available on the morning of October 24, please contact your conference secretary.

October 25 , 2026

Conference room: Ryu-Lab Room, 1st Floor, Engineering Building No. 1
Zoom ID: 863 3027 2313
Zoom Link: <https://us02web.zoom.us/j/86330272313>

Time	Speaker
9:00-9:05	Opening Remark by Assoc. Prof. Dongshik Kang, University of the Ryukyus, Japan
9:05-9:50	Keynote Speech 1 (Online) By Prof. Witold Pedrycz, University of Alberta, Canada (IEEE Fellow)
9:50-10:35	Keynote Speech 2 Prof. Takayuki Nakachi, University of the Ryukyus, Japan
10:35-10:50	Group Photo & Coffee break
10:50-11:35	Keynote Speech 3 By Prof. Mianxiong Dong, Muroran Institute of Technology, Japan
11:35-12:00	Invited Speech 1 By Assoc. Prof. Chenglong Shao, Kyushu Institute of Technology, Japan
12:00-13:30	Lunch time
13:30-13:55	Invited Speech 2 By Assoc. Prof. Shan-Hsiang Shen, National Taiwan University of Science and Technology, Taiwan

October 25 , 2026

Afternoon Sessions	
Conference room: Ryu-Lab Room, 1st Floor, Engineering Building No. 1	
Time	Session
13:55-14:55	Oral Session 1 Session Chair: Assoc. Prof. Chenglong Shao, Kyushu Institute of Technology, Japan Presentations: ES0002-A, ES0006-A, ES0007, ES0016
14:55-15:25	Coffee Break & Poster Session Presentations: ES0003, ES0004-A, ES0011-A
15:25-16:25	Oral Session 2 Session Chair: Assist. Prof. Dr. Tadashi Shiroma, University of the Ryukyus, Japan Presentations: ES5005, ES5006, ES5010, ES5020
17:00-19:00	Dinner time

Note:

- (1) One Best Presentation will be selected from each presentation session, and the Certificate for Best Presentation will be awarded at the end of each session by Session Chairs.
- (2) Regular each Presentation: about 15 Minutes including 2-3 Minutes for Question and Answer.

October 26 , 2026

Zoom ID: 863 3027 2313 Zoom Link: https://us02web.zoom.us/j/86330272313	
Time	Session
10:30-10:55	Invited Speech 3 By Assoc. Prof. Marshima Mohd Rosli, Universiti Teknologi MARA, Malaysia Speech Title: Optimizing Software Bug Prediction Through Stacking and Voting Ensemble Classifiers
10:55-12:10 (GMT+9)	Oral Session 3 (Online) Session Chair: Senior Lecturer Dr. Navaneethan C Arjuman, Multimedia University, Malaysia Presentations: ES0011, ES0008, ES0013, ES0017, ES1001
13:30-14:45 (GMT+9)	Oral Session 4 (Online) Presentations: ES5002, ES5023, ES5017, ES5014, ES5009

Detailed Program

Opening Remark	
Time	9:00-9:05, October 25, 2026
Venue	Ryu-Lab Room, 1st Floor, Engineering Building No. 1



Assoc. Prof. Dongshik Kang

University of the Ryukyus, Japan

Dongshik Kang is a Professor in the Department of Computer Science & Intelligent Systems, Faculty of Engineering, at the University of the Ryukyus, Okinawa, Japan. He received his M.S. degree in Electronic Communication Engineering from the Graduate School of Engineering, Kumoh National Institute of Technology, Republic of Korea, in 1992. From October 1994 to March 1996, he was a research student at the Graduate School of Information Science, Nara Institute of Science and Technology, Japan. He then pursued doctoral studies at Osaka Prefecture University, where he obtained his Ph.D. in Electrical and Information Science from the Graduate School of Engineering in 1999. Dr. Kang began his academic career as a Lecturer in the Department of Electronic Communication Engineering, Faculty of Engineering, Kumoh National Institute of Technology, Republic of Korea, from March 1992 to February 1993. In April 1999, he joined the University of the Ryukyus, Okinawa, Japan, as an Assistant Professor in the Department of Information Engineering, Faculty of Engineering. He was promoted to Associate Professor in April 2005 and has served in this capacity until March 2025. Since April 2025, he has been a Professor in the Department of Computer Science & Intelligent Systems, Faculty of Engineering, at the University of the Ryukyus. In addition to his academic posts, Dr. Kang has engaged in several collaborative research activities with industry and external institutions. From October 2008 to September 2014, he was a joint researcher at Japan Cash Machine Co., Ltd., Osaka, Japan. From 2014 to 2018, he served as a collaborator at the Kansei Fukushi Research Institute, Tohoku Fukushi University, Sendai, Japan. His research interests span a broad range of interdisciplinary fields, including Machine Learning and Intelligent Systems, Audio Information Processing, Biological Data Analysis, Geographic Information Systems (GIS), and Digital Signal Processing.

Dr. Kang has been actively involved in international conferences and collaborative research, publishing widely in journals and proceedings in the fields of computer science, signal processing, and applied intelligent systems. He continues to contribute to the advancement of intelligent system applications in education, healthcare, and environmental monitoring.

Keynote Speech 1 (Online)

Time	9:05-9:50 (GMT+9), October 25 , 2026
Venue	Ryu-Lab Room, 1st Floor, Engineering Building No. 1
Zoom ID:	863 3027 2313
Zoom Link:	https://us02web.zoom.us/j/86330272313



Prof. Witold Pedrycz

(IEEE Fellow)

University of Alberta, Canada

Dr. Witold Pedrycz (IEEE Fellow, 1998) is Professor and Canada Research Chair (CRC) in Computational Intelligence in the Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Canada. He is also with the Systems Research Institute of the Polish Academy of Sciences, Warsaw, Poland. In 2009 Dr. Pedrycz was elected a foreign member of the Polish Academy of Sciences. In 2012 he was elected a Fellow of the Royal Society of Canada. In 2007 he received a prestigious Norbert Wiener award from the IEEE Systems, Man, and Cybernetics Society. He is a recipient of the IEEE Canada Computer Engineering Medal, a Cajastur Prize for Soft Computing from the European Centre for Soft Computing, a Killam Prize, a Fuzzy Pioneer Award from the IEEE Computational Intelligence Society, and 2019 Meritorious Service Award from the IEEE Systems Man and Cybernetics Society. His main research directions involve Computational Intelligence, fuzzy modeling and Granular Computing, knowledge discovery and data science, pattern recognition, data science, knowledge-based neural networks, and control engineering. He has published papers in these areas. He is also an author of 21 research monographs and edited volumes covering various aspects of Computational Intelligence, data mining, and Software Engineering. Dr. Pedrycz is vigorously involved in editorial activities. He is an Editor-in-Chief of Information Sciences, Editor-in-Chief of WIREs Data Mining and Knowledge Discovery (Wiley), and Co-editor-in-Chief of Int. J. of Granular Computing (Springer) and J. of Data Information

and Management (Springer). He serves on an Advisory Board of IEEE Transactions on Fuzzy Systems and is a member of a number of editorial boards of international journals..

Speech Contents

Speech Title: Data and Symbols: Algorithmic Developments of Neurosymbolic Machine Learning for Software Development

Abstract: AI and Machine Learning have assumed a prominent position in software engineering and have led to a number of successful endeavours. It has been recognized that Machine Learning based on masses of data gave rise to a number of challenges in software engineering including hallucinations, lack of mathematical correctness, explainability, and safety requirements. A promising direction has emerged as a unified environment of data and symbols. It has established a promising direction of Machine Learning (ML) by opening a new avenue of learning being often referred to as a neurosymbolic discipline of ML. We advocate that the principles of neurosymbolic processing deliver an interesting possibility to explore data and knowledge with an ultimate intent to realize efficient learning and combat the scaling law of AI.

Symbols are central to the representation, elicitation, and processing of knowledge. From the design perspective of the ML learning environment, data and knowledge are conceptually distinct as they arise at different levels of information granularity.

In the talk, we proceed with a historical perspective of connectivism and symbolism as raised by many in AI including Minsky and Smolensky, among others, and demonstrate the inherent complementarity of these two positions. To benefit from the learning paradigms of ML, we investigate ways of elicitation of symbols and their structuralization into rules or graphs.

The general taxonomy of neurosymbolic constructs involving main categories such as learning-for-reasoning, reasoning-for-learning, reasoning-learning is discussed. We elaborate on the design process being guided by a prudently structured additive loss function whose corresponding parts minimize distances between the developed ML model and numeric target values and deliver adherence of the model to information granules reflecting available knowledge. It is also shown that the symbolic facet of neurosymbolic offers a unique property of ML guard railing. Representative examples of neurosymbolic ML architectures including those of stable rule-based models and cognitive maps are discussed.

Keynote Speech 2

Time	9:50-10:35 (GMT+9), October 25 , 2026
Venue	Ryu-Lab Room, 1st Floor, Engineering Building No. 1



Prof. Takayuki Nakachi

University of the Ryukyus, Japan

Takayuki Nakachi is a Professor at the Information Technology Center, University of the Ryukyus, Japan. His research spans sparsity-based AI, quantum-inspired machine learning, secure signal processing, and ultra-high-definition video coding. In particular, he focuses on small-data, interpretable, and trustworthy AI leveraging sparse modeling and Gaussian processes. He has authored over 150 peer-reviewed journal and international conference papers in these fields.

Prior to joining the University of the Ryukyus in April 2021, he had a distinguished research career at Nippon Telegraph and Telephone Corporation (NTT), where he was primarily engaged in ultra-high-definition video coding and transmission. From 2006 to 2007, he was a Visiting Researcher at Stanford University, USA, conducting pioneering research on distributed video coding, and subsequently contributed to the ISO/IEC MPEG Media Transport (MMT) international standardization.

Dr. Nakachi received his Ph.D. degree in engineering from Keio University in 1997. He plays a prominent role in international academic leadership, having served as General Chair and Chair of the International Steering Committee for international conferences, alongside key technical committee roles in IEEE and IEICE. He has received prestigious recognitions, including the 26th Telecom System Technology Award, the ACM ICAAI 2024 Best Presentation Award, and the IEEE WSCE 2023 Best Presentation Award.

Speech Contents

Speech Title: Towards Trustworthy Edge AI: Unifying Privacy Preservation and Active Defense in Transparent Machine Learning

Abstract: As machine learning models are increasingly deployed across distributed edge and cloud environments, safeguarding data privacy and protecting models against active security threats have become critical challenges. This keynote presentation presents a secret-keyed Random Unitary Transform (RUT) framework for transparent machine learning in Edge AI, unifying data privacy protection and active security defense. Focusing primarily on sparse modeling, we first review a privacy-preserving computation method that operates directly on encrypted inputs, where the geometric isometric properties of RUT guarantee full inference utility for authorized users. Building on this privacy foundation, we demonstrate how RUT extends to active defense mechanisms against major security threats: key mismatch induces spatial gradient mismatches and structural disorientation, effectively neutralizing gradient-based adversarial evasion attacks and frustrating unauthorized model extraction attempts. Additionally, we briefly highlight that this framework similarly enables data privacy in Gaussian processes, providing effective resistance against membership inference attacks. Ultimately, this work establishes mathematical principles bridging data confidentiality and attack resilience for trustworthy Edge AI systems.

Group Photo & Coffee Break 10:35-10:50

Keynote Speech 3

Time	10:50-11:35, October 25, 2026
Venue	Ryu-Lab Room, 1st Floor, Engineering Building No. 1



Prof. Mianxiong Dong

Muroran Institute of Technology,
Japan

Mianxiong Dong received B.S., M.S. and Ph.D. in Computer Science and Engineering from The University of Aizu, Japan. He is the Director and Professor of Center for Computer Science at Muroran Institute of Technology, Japan. He was a JSPS Research Fellow with School of Computer Science and Engineering, The University of Aizu, Japan and was a visiting scholar with BBCR group at the University of Waterloo, Canada supported by JSPS Excellent Young Researcher Overseas Visit Program from April 2010 to August 2011. Dr. Dong was selected as a Foreigner Research Fellow (a total of 3 recipients all over Japan) by NEC C&C Foundation in 2011. He is the recipient of The 12th IEEE ComSoc Asia-Pacific Young Researcher Award 2017, Funai Research Award 2018, NISTEP Researcher 2018 (one of only 11 people in Japan) in recognition of significant contributions in science and technology, The Young Scientists' Award from MEXT in 2021, SUEMATSU-Yasuharu Award from IEICE in 2021, IEEE TCSC Middle Career Award in 2021. He is Clarivate Analytics 2019, 2021, 2022, 2023, 2025 Highly Cited Researcher (Web of Science) and Foreign Fellow of EAJ.

Speech Contents

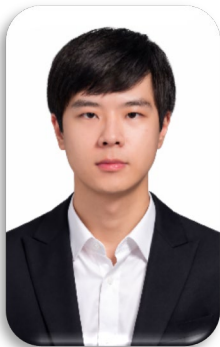
Speech Title: From Connectivity to Content: Rethinking Communication for 6G Applications

Abstract: Wireless communication has traditionally focused on faster connections and greater capacity. Yet when disasters disrupt infrastructure, restoring connectivity alone is insufficient: limited bandwidth demands a shift from how to transmit to what to communicate. This keynote explores a transition from connectivity-centric to content-centric communication for 6G applications. We introduce the Aero, Terra and Human system for emergency connectivity and discuss how semantic communication prioritizes task-relevant meaning over raw bit streams. Building on image and video communication examples, we examine how world models can incorporate environmental context, prior knowledge, and rescue objectives to transform raw observations into meaningful content. We further explore their potential to reconstruct environmental and network states from incomplete observations and predict changing conditions to support proactive resource deployment.

Together, these perspectives outline a vision of meaning-aware, task-oriented 6G systems that not only transmit information efficiently but also generate and deliver the right content for the task at hand.

Invited Speech 1

Time	11:35-12:00, October 25, 2026
Venue	Ryu-Lab Room, 1st Floor, Engineering Building No. 1



Assoc. Prof. Chenglong Shao

Kyushu Institute of Technology, Japan

Dr. Chenglong Shao is an Associate Professor in the Department of Electronics and Information Communication Engineering at Kyushu Institute of Technology, Japan, a position he has held since 2026. He received his B.S. in Information and Communications Engineering from Xi'an Jiaotong University, China, in 2010, and his Ph.D. in Computer Science and Engineering from Korea University, South Korea, in 2019. He previously served as a Research Professor at Korea University in 2019, a JSPS International Research Fellow at Kyushu University from 2021 to 2023, and a Visiting Scholar at the University of California, Riverside, in 2024. His research interests span wireless networking, IoT-enabled mobile computing, wireless security, and networked embedded systems. He has authored over 30 first-author papers in leading international journals and conferences, including IEEE Transactions on Mobile Computing and IEEE/ACM Transactions on Networking. His work has been recognized with more than 10 international awards, such as the CANDAR 2022 Best Paper Award, the 25th Samsung Humantech Paper Award – Bronze Prize in 2019, and the 1st Place Transactions Award of 2018 Annual IEEE Consumer Electronics Society Chester W. Sall Memorial Awards in 2018. He is an active member of the research community, contributing as a TPC member at over 20 international conferences and as a reviewer for more than 40 academic journals.

Speech Contents

Speech Title: Pushing the Limits of LoRa Communications in Ultra-Low SNR Environments

Abstract: Long-range wide area network (LoRaWAN) has emerged as a leading wireless communication technology for the Internet of Things (IoT) because of its long-range and low-power capabilities. However, dead-zone LoRa communication remains a major challenge, where end devices experience ultra-low signal-to-noise ratios (SNRs) at gateways due to environmental factors such as signal blockage, reflection, and severe attenuation in urban and indoor environments. Existing solutions primarily rely on additional hardware, deep learning-based techniques, or repeated signal retransmissions. However, these approaches suffer from increased deployment costs, scalability issues, and energy inefficiencies. In this paper, we propose DeLoRa, a novel physical-layer solution that enables reliable LoRa communication in dead zones without requiring extra hardware, deep learning models, or excessive signal retransmissions. DeLoRa introduces chirp redundancy, which enhances demodulation robustness by improving the signal's distinguishability from the noise floor. We validate DeLoRa through extensive real-world experiments in different environments. Our results show that DeLoRa significantly enhances LoRaWAN coverage by at least 48%, making it a practical solution for large-scale IoT deployments.

Lunch: 12:00-13:30

Invited Speech 2

Time	13:30-13:55, October 25, 2026
Venue	Ryu-Lab Room, 1st Floor, Engineering Building No. 1



**Assoc. Prof. Shan-Hsiang
Shen**

**National Taiwan University of
Science and Technology, Taiwan**

Shan-Hsiang received the M.S. degree from National Chiao Tung University, Republic of China, in 2004, and the Ph.D. degree from the University of Wisconsin, USA, in 2014. He is currently an Associate Professor with the Computer Science and Information Engineering Department, National Taiwan University of Science and Technology, Taiwan.

His main research interests include software-defined networking, network function virtualization, network security, and cloud computing.

Speech Contents

Speech Title: Named Image-Layer Networks for Containers

Abstract: In recent years, continuous integration and continuous deployment (CICD) have become industry standards in software development, aiming for automatic and efficient build and deployment processes. Nonetheless, integrating core frameworks and similar packages in each build often leads to redundancy, time wastage, and overall efficiency reduction. Our study focuses on optimizing the CICD process, particularly in package management and data storage efficiency. It utilizes Network File System (NFS), which employs a robust caching mechanism, to store and deliver the necessary packages and resources. This approach significantly reduces redundant downloads and storage, enhancing efficiency. In addition, we identify challenges in package transmission and storage under the existing network architecture. To overcome these challenges, we propose the Named Image Layer Networking (NIN) technology to optimize package management and retrieval. The integration of NIN allows for a more effective selection of optimal caching nodes, thereby further improving the efficiency of the CICD process.

Invited Speech 3 (Online)

Time	10:30-10:55 (GMT+9), October 26, 2026
Zoom ID:	863 3027 2313
Zoom Link:	https://us02web.zoom.us/j/86330272313



Assoc. Prof. Marshima Mohd Rosli

Universiti Teknologi MARA, Malaysia

Marshima Mohd Rosli is an Associate Professor in the Department of Computing Sciences at the College of Computing, Informatics, and Mathematics, Universiti Teknologi MARA, Malaysia. She holds a PhD in Computer Science from the University of Auckland, New Zealand. Her research primarily focuses on software engineering, system development, artificial intelligence, and data analytics. She has contributed numerous publications to renowned conferences and journals such as IEEE and ACM.

Speech Contents

Speech Title: Optimizing Software Bug Prediction Through Stacking and Voting Ensemble Classifiers

Abstract: Early bug prediction is critical for software quality, yet manual methods are inefficient and current machine learning models often struggle with high false-positive rates. To address these limitations, this study proposes an ensemble-based approach designed to proactively predict the specific severity of software bugs (Critical, High, Medium, Low). Utilizing Java metrics from the BugsJar and Defects4J repositories, the methodology implemented the Synthetic Minority Oversampling Technique (SMOTE) to resolve severe class imbalances. Five diverse base algorithms (XGBoost, Random Forest, Logistic Regression, SVC, and Gradient Boosting) were optimized via the Optuna framework and aggregated into hierarchical Voting and Stacking architectures. Empirical results demonstrated that the Stacking Classifier outperformed the Voting Classifier, achieving a mean cross-validation accuracy of 83.22% compared to 78.58%. However, a drop in test accuracy (63.12% for the Stacking model) revealed limitations regarding model overfitting and separating adjacent severity classes. Ultimately, this approach demonstrates significant potential for efficient defect management. Future iterations will prioritize advanced regularization to improve model generalization and integrate the system directly into CI/CD pipelines to streamline testing and prevent vulnerabilities early in the development lifecycle.

Oral Session 1 (13:55-14:55)

Topic: Intelligent System Security Defense and IoT Applications

Session Chair: Assoc. Prof. Chenglong Shao, Kyushu Institute of Technology, Japan

Time: 13:55-15:10, October 25, 2026

Venue: Ryu-Lab Room, 1st Floor, Engineering Building No. 1

***Presenters are recommended to enter the meeting room 10 mins in advance.**

***Presenters are recommended to stay for the whole session in case of any absence.**

***After the session, there will be a group photo for all presenters.**

ES0002-A (13:55-14:10)

Adaptive Secure Trust Management for Lifetime Maximization in LPWAN-Based IoT Systems

Hamid AlHamadi

Kuwait University, Kuwait

Abstract- The deployment of long-term, autonomous Internet of Things (IoT) systems, particularly in the context of Low Power Wide Area Networks (LPWANs), is constrained by a fundamental conflict between security requirements and finite energy resources. Security protocols, such as trust management, introduce significant operational overhead, yet their impact on system lifetime is rarely modeled as a core design parameter. This work presents a novel decision-making framework to formally quantify and optimize the price of trust, and demonstrates its application through a LoRaWAN -based system. We develop a generalized cost model for trust activities and formulate an optimization problem to derive policies that maximize the Mean Time To Failure (MTTF) while meeting reliability constraints. The framework yields both a static policy for optimal baseline configuration and an adaptive mechanism where security posture is dynamically adjusted in response to evolving threats. The result is a foundational methodology for designing sustainable smart systems, with our LoRaWAN analysis providing a concrete validation of its effectiveness. The result is a foundational methodology for designing sustainable and resilient smart systems.

ES0006-A (14:10-14:25)

How the Spectral Gap Enters Convergence Rates in Stochastic Decentralized Learning

Thi Phuong Tran and Le Trieu Phong

National Institute of Information and Communications Technology, Japan

Abstract- Decentralized learning is vital for cloud-edge-IoT systems, where data is spread across resource-limited devices. Instead of relying on a central server, nodes communicate through sparse peer-to-peer networks, making network connectivity crucial to learning efficiency. A key measure of this connectivity is the spectral gap of the communication graph, though its impact is often hidden in convergence bounds. This talk provides a unified view of how the spectral gap affects stochastic decentralized learning. We compare five algorithms: Choco-SGD, BEER, MoTEF, CHEER, and CHOFT. The main message is that spectral-gap dependence is shaped not only by graph topology, but also by how each algorithm controls disagreement, compression error, stochastic noise, and gradient tracking. Choco-SGD has a squared inverse spectral-gap penalty, while BEER, CHEER, and MoTEF exhibit cubic dependence due to multiple coupled recursions. CHOFT improves this to squared dependence by combining compressed consensus with full gradient tracking. The talk emphasizes topology-aware algorithm design for communication-efficient decentralized learning in future cloud-edge-IoT systems.

ES0007 (14:25-14:40)

Robust DNN Ownership Verification Using Soft-Label-Controlled Adversarial Examples under Composite Image Preprocessing

Naoto Katakai, Shu Takemoto, Yusuke Nozaki and Masaya Yoshikawa

Meijo University, Japan

Abstract- Deep neural network (DNN) models represent valuable intellectual property because they require extensive computational resources and large-scale training data. As DNN models are increasingly deployed through cloud services and APIs, verifying model ownership has become essential to protect them from unauthorized reuse, replication, and model stealing. Among existing verification methods, adversarial example (AE)-based model fingerprinting enables ownership verification by controlling the output distribution of a target model even in black-box settings. However, in practical cloud environments, input images are often processed by preprocessing operations such as cropping and resizing (CR) and JPEG compression before inference. Since AE-based fingerprints rely on small perturbations, these transformations can distort the perturbation patterns and degrade the intended fingerprint responses, thereby reducing the reliability of ownership verification. This study proposes a robust AE-based model fingerprint generation method that maintains fingerprint responses under combined CR processing and JPEG compression. The proposed method incorporates Expectation over Transformation (EOT) into the fingerprint optimization process by considering multiple combinations of CR ratios and JPEG quality factors. Furthermore, the optimization simultaneously considers the original input without preprocessing to maintain consistent fingerprint responses both

before and after preprocessing. Experimental results demonstrate that the proposed method significantly improves the robustness of model fingerprints against practical input preprocessing while preserving their effectiveness for model ownership verification.

ES0016 (14:40-14:55)

Fall Detection System on Escalator Using Image-Based Artificial Intelligence Techniques

Minsung Park¹, Jeonghyeop Park¹, Huijin Rim², Dongmin Seo¹ and Bohee Lee¹

1: Semyung University, Republic of Korea

2: AI Research Center, SEASON Co. Ltd., Sejong, Republic of Korea

Abstract- Fall detection for users of public facilities is an important means of preventing serious safety accidents and enabling rapid response when an accident occurs. In particular, fall detection systems deployed in real-world environments require a lightweight architecture capable of continuous operation under limited computational resources and network conditions. In this study, an escalator fall detection and alert system was implemented using edge artificial intelligence and Internet of Things (IoT) technologies on a Raspberry Pi 5. YOLO11n-pose was used to extract the bounding box and COCO17 body keypoints of a user from camera images, and the extracted pose information was transformed into temporal pose features and analyzed using a Temporal CNN to determine whether a fall had occurred. In addition, when the Temporal CNN detected a FALL candidate, a rule-based verification procedure using the Bounding Box Ratio, Pose Ratio, Body Axis Ratio, and Head-Foot Compression Ratio was applied as an additional verification step. The Temporal CNN was further fine-tuned using AI-Hub escalator fall data based on a model previously trained with the VideoFall dataset, and the final model was implemented for real-time inference on a Raspberry Pi platform. When a fall was detected, the associated image and analysis information were stored in Firebase and made remotely accessible through a Streamlit-based monitoring interface. A real-time demonstration was also conducted in a stair environment involving normal activities and repeated simulated fall motions. The results confirmed that the entire processing pipeline, including image acquisition, person detection, pose feature extraction, fall detection, and result visualization, operated continuously in real time. These results demonstrate the feasibility of the proposed system for edge-based real-time fall detection and remote monitoring.

Coffee Break
14:55-15:25

Oral Session 2 (15:25-16:25)

Topic: Software Architecture Design and Human-Computer Interaction

Session Chair: Assist. Prof. Dr. Tadashi Shiroma, University of the Ryukyus, Japan

Time: 15:25-16:25, October 25, 2026

Venue: Ryu-Lab Room, 1st Floor, Engineering Building No. 1

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ES5005 (15:25-15:40)

Design Tools for Microservices Governance: Aligning API Gateways with TOGAF

Using the ATIF Framework

Tee Hean Tan and Too Khong Tan

Sunway University, Malaysia

Abstract—Microservices architectures offer speed and flexibility, but they also create governance challenges. API gateways—central components for managing client access to microservices, security, and routing—often evolve independently of enterprise architecture frameworks such as TOGAF. This independence leads to configuration drift, inconsistent security policies, and the spread of architectural anti-patterns. Existing approaches either focus on the technical aspects of microservices—such as exposing them via API gateways—without enterprise alignment, or apply TOGAF only at strategic planning levels, without addressing runtime governance. To bridge this gap, this paper proposes the API-TOGAF Integrated Framework (ATIF), a design framework that systematically aligns the API gateway lifecycle with TOGAFs Architecture Development Method (ADM). From a software design tools perspective, ATIF contributes to four areas: (1) requirement specification languages—TOGAF ADM provides structured phases for capturing architectural requirements; (2) integrated software design—ATIF translates governance policies into executable gateway configurations; (3) scenario-based model synthesis—the Enterprise Continuum stores reusable gateway patterns for common governance scenarios; and (4) microservices governance—the framework addresses configuration drift and anti-pattern proliferation. ATIF comprises three modules: (1) Strategic Alignment, (2) an Architecture Development Method (ADM) for microservices

APIs, and (3) API Governance Components. The framework provides a structured blueprint for enterprises seeking to harmonize microservices agility with enterprise governance.

ES5006 (15:40-15:55)

Analyzing Corpus Reuse in Coverage-Guided Fuzzing with Library-Level Coverage

Taiga Ogawa and Tadashi Shiroma

University of the Ryukyus, Japan

Abstract—Coverage-guided fuzzing produces corpora that encode useful structural knowledge about program inputs. This paper studies whether such corpora can be reused across related fuzzing targets, especially when corpora generated by fuzzing dependency libraries are reused to fuzz applications that delegate input processing to those libraries. We first use prior firmware experiments as a motivating study: corpus reuse improved path discovery in several settings, but the results did not re-veal which functions or libraries benefited. We then conduct an OSS-Fuzz-based study on image-processing software to analyze corpus reuse with source-level and library-level coverage. We fuzz image-png/decode and libpng/libpng_read_fuzzer, then reuse their generated corpora for ImageMagick’s PNG encoder fuzzer. The PNG experiments show that image-png, libpng, and mixed PNG corpora increase the number of cov-ered functions in ImageMagick by 101.6, 26.8, and 107.6 on average over the baseline, respectively. Library-level coverage shows that these gains occur not only in ImageMagick but also in libpng, zlib, and Little-CMS. These results show that corpus reuse can transfer input-structure knowledge, but practical reuse requires format compatibility and evidence that the target reaches the intended libraries and functions.

ES5010 (15:55-16:10)

Shifting Paradigms in Healthcare Interoperability: A Systematic Review of Service-Oriented and Microservice Architectures in Medical Systems

Chun-Sheng Li^{1,2}, Shang-Pin Ma² and Tsung-Hsi Lin¹

1: Institute for Information Industry, Taiwan

2: National Taiwan Ocean University, Taiwan

Abstract—The continuous advancement of information and communication technology drives the evolution of software system architectures. In medical informatics, di-verse operational requirements and the closed, complex nature of existing systems influence this evolution. In this paper, we use a systematic literature review to examine trends in medical

informatics system architectures in the past two decades. For the period from 2007 to 2026, we collected 110 publications about service-oriented and microservice architectures in this domain. We then selected 15 papers from each paradigm for in-depth analysis. The results reveal a shift from SOA-driven legacy-system modernization toward MSA-based development of new healthcare applications, accompanied by a transition from HL7v3/CDA toward HL7 FHIR. The review further identifies future research opportunities in automated testing, service orchestration, and privacy-preserving simulation.

ES5020 (16:10-16:25)

Designer-as-Developer: Iterative Design and Development of an LLM-Based Dementia-Caregiver Chatbot

Chor-Kheng Lim¹, Hsien-Hui Tang² and Chia-Chi Chang³

1: Yuan Ze University, Taiwan

2: National Taiwan University of Science and Technology, Taiwan

3: Taipei Medical University, Taiwan

Abstract—Family caregivers of people with dementia need timely, emotionally attuned guidance, and large language models (LLMs) now make round-the-clock conversational support feasible; yet building a chatbot that empathizes, assesses, and only then advises is an interaction-design problem as much as an engineering one. This paper reports the iterative design, development, and deployment of a LINE-based dementia-caregiver chatbot built on Google Apps Script over a WHO iSupport knowledge base, and examines whether one design decision is accompanied by a measurable change in an observable dialogue behavior. Developed under a designer-as-developer configuration through a tight build–test–revise loop, the system ran in real-world deployment for four months (4 April–13 August 2026; 635 dialogue turns, 21 users). The work is organized around four design frontiers, model behavior, empathy and assessment, knowledge grounding, and caregiver-role adaptation, and, for the one-question clarification rule introduced on 10 August, compares logs before and after: the share of clarifying turns asking two or more questions fell from 96% (242/252) to 58% (28/48) and the mean from 2.88 to 1.65 questions per turn; the versions also differed in caregiver role and prompt content, so the authors report this as an observed difference co-incident in timing with the rule, not as its effect. The iterations suggest that literal rules can produce mechanical responses and may need context-sensitive refinement through iterative testing, and the resulting decisions are offered as transferable guidance for building emotionally sensitive healthcare chatbots.

Poster Session (14:55-15:25)

Topic: Augmented Reality and IoT Systems

Time: 14:55-15:25, October 26, 2026

ES0003

Collaborative Single-UAV and Ground Sensor Network Architecture for Precision Primate Detection and Defense in Complex Orchard Environments

Sung-Wen Wang¹, Shih-Ming Cho¹, Chia-Ping Huang² and Huan-Jung Lin³

1: Tatung University, Taiwan

2: Hsing-Wu University, Taiwan

3: National Formosa University, Taiwan

Abstract- The high spatial overlap between agricultural land and wildlife habitats in Taiwan's low-elevation mountain areas has intensified crop damage caused by Formosan macaques (*Macaca cyclopis*), particularly in high-value mango and lychee orchards. Conventional defense mechanisms, ranging from physical barriers to passive deterrents, are frequently compromised by the primates high cognitive adaptability and habituation. Moreover, existing single-modal monitoring systems struggle with highly unstructured environments and poor energy efficiency: stationary cameras often fail to cover blind spots in rugged terrain, while continuous UAV patrols are restricted by battery energy density and the risks associated with nocturnal flight. To address these challenges, this study proposes an innovative Collaborative Single-UAV and Ground Wireless Sensor Network (WSN) Architecture designed for all-weather precision detection and verification in complex orchard environments. The architecture utilizes an End-Edge-Cloud layered design, where a low-power ground WSN serves as the primary event-triggering layer and a single Unmanned Aerial Vehicle (UAV)—equipped with a high-performance edge computing core—functions as the secondary high-precision verification layer. The technical framework integrates four core innovations: (1) An asynchronous LoRaWAN-based wake-up protocol; (2) A Single-Anchor Ultra-Wideband (UWB) collaborative localization algorithm; (3) Heterogeneous RGB-T image fusion coupled with Amodal Instance Segmentation (AIS); and (4) A trusted data architecture incorporating Blockchain Oracles. Experimental results demonstrate that this collaborative architecture maintains high detection recall even with occlusion rates exceeding 30%, while significantly extending operational endurance. Furthermore, the system offers a solution for Smart Agriculture 5.0 that is economically viable, technically robust, and ecologically ethical.

ES0004-A

A Cloud-Based Decision Support System for Reliability Acceptance Sampling in Industrial IoT Manufacturing

To-Cheng Wang

Republic of China Air Force Academy, Taiwan

Abstract—Reliability acceptance decisions in IoT-enabled manufacturing increasingly rely on lifetime data collected from connected products, test equipment, and distributed quality-control sites. However, life tests are costly and time-consuming, and censored observations make it difficult for engineers to translate reliability requirements into consistent lot-disposition rules. This study proposes a cloud-based decision support system for reliability acceptance sampling using a lifetime-performance index. The system integrates contract-based risk specification, automatic sampling-plan optimization, censored lifetime-data processing, distributional adequacy checking, lot acceptance/rejection recommendations, and cloud report archiving. By deploying the sampling design and decision workflow as a web-based service, the proposed system reduces the dependence on static design tables and manual numerical computation, while improving transparency, reproducibility, and traceability across manufacturing and supply-chain partners. The proposed framework is especially suitable for industrial IoT and smart manufacturing environments, where reliability data may be generated at multiple edge sites and consolidated through cloud platforms. It provides a practical bridge between reliability engineering models and cloud-IoT-enabled quality governance.

ES5011-A

Coordinate-Based Gesture Interaction for an AR Virtual Pet System

Chin-Chen Chang

National United University, Taiwan

Abstract—With the rapid advancement of augmented reality (AR) technology, virtual pets have become an important application for enhancing user engagement. Gesture interaction further improves the naturalness and immersion of human-computer interaction in AR environments. This paper proposes a real-time gesture interaction system for virtual pets based on changes in hand coordinate trajectories. The system employs a hand skeleton recognition module to extract key hand landmarks from images captured by a mobile device and analyzes coordinate variations to recognize user gestures. Six intuitive gestures are designed to support responsive and natural interactions with virtual pets. Experimental results demonstrate that the proposed coordinate-based approach achieves high accuracy while maintaining real-time performance. Compared with previous approaches, the proposed method provides higher average accuracy with lower computational complexity. The results indicate that coordinate-change-based gesture interaction is an effective and efficient solution for AR applications, offering improved interaction quality and a promising framework for future immersive virtual pet and human-computer interaction systems.

Online-Oral Session 3 (10:55-12:10 GMT+9)

Topic: Intelligent System Control and Cybersecurity
Senior Lecturer Dr. Navaneethan C Arjuman, Multimedia University, Malaysia
Zoom ID: 863 3027 2313
Zoom Link: <https://us02web.zoom.us/j/86330272313>

***Presenters are recommended to join the zoom 10 mins in advance.**
***After the session, there will be a group photo for all presenters.**

ES0011 (10:55-11:10 GMT+9)

Uncertainty-Aware Two-Path Gating for ML-Augmented FaaS Scheduling on the Edge-Cloud Continuum

Sienna S Lee¹, Hanku Lee¹ and Jaden J Lee²

1: Minnesota State University Moorhead, United States

2: Harvard University, United States

Abstract—Scheduling across the edge-cloud continuum requires balancing placement quality against decision-time computation. Selective inference reserves expensive refinement for difficult requests, but identifying them remains challenging. Confidence-gap gating captures candidate ambiguity without revealing whether the leading candidates remain stable under predictive uncertainty. We introduce Uncertainty-Aware Two-Path Gating for ComFaaS-ML, augmenting gap-based routing with decision flip uncertainty (U_{flip}), a decision-centric signal derived from Monte Carlo dropout samples. This signal measures how often predictive perturbations reverse the deterministic Top-1/Top-2 ordering. The scheduler invokes neural reranking when candidate ambiguity or decision instability warrants refinement. To isolate routing quality, gap-only and uncertainty-aware policies are calibrated on an independent development split under the same Slow Path budget. We evaluate heuristic, always-on ML, and both hybrid configurations using a reproducible five-seed protocol. At essentially the same 20% S3 invocation rate, Uncertainty Hybrid improves mean Oracle Match from 75.40% to 75.52% and reduces mean p95 Gap from 1.41 to 1.39 ms, with Oracle Match improving across all five seeds. These results suggest that decision-centered uncertainty can complement confidence-gap information when allocating limited neural refinement.

ES0008 (11:10-11:25 GMT+9)

A Representation-Aware Evaluation of Predictive Performance and SHAP Explanations for Malicious URL Detection

Linh Le Thi Trang and Tung Thanh Hoang

Electric Power University, Vietnam

Abstract—Malicious URL detection studies often emphasize predictive accuracy, whereas model explanations are commonly reported through feature-importance plots without examining whether the identified features are concentrated, reproducible, or behaviorally relevant. This study compares three URL-classification pipelines: TF-IDF with Logistic Regression, a character-level CNN, and a character-level LSTM, using 388,447 labeled URLs. All pipelines are evaluated on the same stratified test set using Accuracy, Precision, Recall, and F1-score. SHAP explanations are further examined through top-20 contribution concentration, Kuncheva stability across repeated explanation samples, and perturbation against randomly selected features or positions. The CNN achieves the highest Accuracy and F1-score, at 98.13% and 91.07%, respectively, while TF-IDF-LR obtains the highest Recall of 96.10%. The explanation results do not consistently align with predictive performance. LSTM shows the highest top-20 concentration and the largest positive perturbation gap, but its important positions are weakly reproducible. In contrast, LR achieves the highest stability, with a Kuncheva score of 0.725 ± 0.064 , although masking its top-ranked features does not reduce the malicious-class probability as expected. These findings suggest that concentration, reproducibility, and perturbation response capture different aspects of SHAP explanations. The study provides a representation-aware basis for comparing URL detection pipelines with heterogeneous input spaces.

ES0013 (11:25-11:40 GMT+9)

Explainable BC7-Resilient Watermarking for Cloud-Edge Content Protection Using Compression-Aware Block Selection

Thi Trang Linh Le and **Dang Khue Pham**

Electric Power University, Viet Nam

Abstract—In cloud-edge content delivery systems, graphical assets may undergo compression and format conversion before storage, transmission, or rendering, which can affect the recovery of embedded watermarks used for copyright protection. This paper presents APEX, a BC7-oriented watermarking framework motivated by the observation that watermark robustness depends not only on how information is embedded, but also on

where it is embedded. APEX uses the block-mean distortion caused by BC7 encoding and decoding as part of the Ant Colony Optimization heuristic for selecting suitable 4x4 blocks. The watermark is then embedded into the selected blocks using Adaptive Block-Mean QIM. Experiments on game-card artwork yield an average PSNR of 52.98 dB, an SSIM of 0.9987, and a BER of 0.0250. Ablation results show that removing BC7-aware block selection increases the BER by more than tenfold, from 0.0250 to 0.2742, whereas replacing the adaptive embedding scheme with fixed-step QIM increases the BER only to 0.0350. Independent evaluation on BOSSBase yields an NC of 0.9999 and a BER of 0.0003 after BC7 encoding and decoding. These results show that compression-aware block selection can improve watermark recovery when graphical assets undergo BC7 compression.

ES0017 (11:40-11:55 GMT+9)

Enhanced Detection Mechanism to Detect Tiny Fragment Attack in IPv6 Network

Navaneethan C Arjuman¹, Vinnosh Rau Samudram¹, Vimalrich Selvam Nadarajah¹, Selvakumar Manickam² and Supriyanto Praptodiyono³

1: Multimedia University, Malaysia

2: Cybersecurity Research Centre Universiti Sains Malaysia Penang, Malaysia

3: Faculty of Computer Sciences UPN "Veteran" Jakarta, Jakarta Selatan, Indonesia

Abstract—With the rapid adoption of IPv6 globally, many security challenges have arisen, especially via fragmentation-based evasion attacks. Tiny fragment attacks deliberately split packets into abnormally small fragments to bypass intrusion detection systems (IDS) that work on per-packet inspection. Existing tools such as Suricata and Snort which use signature-based per-packet rules that lack flowlevel context, result in high false-positive rates when they detect these tiny fragment attacks. This paper proposes an enhanced IDS that detects tiny fragment attacks using two behavioral flow-level metrics: Tiny Fragment Ratio ($M2$) and Payload Size Standard Deviation ($M3$). The system was tested in a controlled Mininet virtual testbed across three different traffic rates against both baseline tools. Though still early in research, results demonstrate perfect precision of 1.000 with zero false positives across all tiers. A C++ reimplementaion that is compiled with PACKET_MMAP zero-copy capture further improved high-tier recall from 0.711 to 0.947, achieving F1-scores of 1.000, 1.000, and 0.973 at low, medium, and high traffic tiers respectively, outperforming Suricata (F1: 0.543, 0.547, 0.544) and Snort (F1: 0.889, 0.931, 0.767). However, future work includes more test scenarios to further validate the mechanisms ability in mitigating these attacks.

ES1001 (11:55-12:10 GMT+9)**RFID-based Intelligent Dispatching and Command System for Vehicle Depots in Urban Rail Transit**

Wenrui Yang¹, Qian Wan¹, Vimalrich Selvam Nadarajah¹ and Weidong Fang³

1: Jinhua Rail Transit Holding Group Operation Co., Ltd., China

2: Shanghai Institute of Microsystem and Information Technology, China

Abstract—Urban rail transit vehicle depots are operational support units that intensively couple multiple production tasks, including train stabling, maintenance and repair, operation, and comprehensive repair; their dispatching processes are characterized by diverse information sources, stringent operational constraints, frequent plan changes, and a high degree of safety relevance. To address the information latency, plan conflicts, and insufficient collaborative efficiency associated with the production organization of traditional vehicle depots that relies on telephonic communication, paper work orders, and human experience, this paper develops an intelligent dispatch command system oriented to multi-disciplinary collaborative scheduling in vehicle depots. First, the core business processes of train inbound, train outbound, shunting, maintenance and repair, construction, and catenary power disconnection/reconnection are organized, and a layered architecture of “perception and interface—data fusion—intelligent decision making—business application” is constructed. Second, methods for RFID-based train identity recognition and position tracking, multi-source status data fusion, and automatic generation of train inbound/outbound plans are developed, with the timetable, vehicle maintenance status, track occupancy, construction works, and power supply status uniformly incorporated into constraint checking. Finally, the human-machine collaborative dynamic adjustment mechanism and the application value of the system are discussed. The results show that this framework can transform fragmented production information into unified, real-time dispatchable resource status, support the organization of train inbound and outbound operations through rule constraints and plan optimization, and provide an implementable technical pathway for vehicle depots to transition from experience-driven to data-driven and from decentralized dispatching to collaborative dispatching.

Online-Oral Session 4 (13:30-14:45 GMT+9)

Topic: Software Modeling, Architectural Design, and Multimodal Intelligent Applications

Zoom ID: 863 3027 2313

Zoom Link: <https://us02web.zoom.us/j/86330272313>

***Presenters are recommended to join the zoom 10 mins in advance.**

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ES5002 (13:30-13:45 GMT+9)

Exploratory vs Test Case-Based Testing: An Empirical Study in Software Testing Education among Malaysian University Students

Nor Shahida Binti Mohamad Yusop

Universiti Teknologi MARA, Malaysia

Abstract—This study addresses the empirical gap in software testing education within the Malaysian higher education context by comparing the effectiveness of Exploratory Testing (ET) and Test Case-Based Testing (TCT). While global re-search offers conflicting results on these methodologies, localized data is necessary to guide curriculum enhancements for novice testers. An experiment was conducted at Universiti Teknologi MARA involving 23 undergraduate information systems students divided into four project teams. Following a cross-testing approach, students performed both TCT and ET on web-based systems developed by their peers. Performance was measured using defect yield, defect rejection rates (DRR), and defect report quality. The results indicate a distinct trade-off: ET demonstrated a significantly higher defect yield, averaging 0.650 valid defects per test case compared to TCT’s 0.233. However, ET also resulted in a higher average DRR of 23.69%, nearly double that of TCT (12.18%), suggesting that unscripted testing introduces more "noise" and requires more rigorous triage. Notably, ET was more effective at uncovering high-severity logic is-sues, supporting its role as a high-powered discovery tool. Conversely, TCT pro-vided more reliable, high-quality reporting due to structured documentation. These findings suggest that ET should be integrated into software testing curricula as a complementary approach to traditional scripted methods to better prepare students for the demands of the agile software industry.

ES5023 (13:45-14:00 GMT+9)

Carving Back into the Process: Production-Informed AI Process Evolution: An AI-Enabled CAD/CAM Case Study

Razan Abualsaud

Independent Researcher, Saudi Arabia

Abstract—Software engineering has long recognized that development processes are not fixed prescriptions, but engineered objects that can themselves evolve. For ML-enabled systems, however, this principle acquires a new dimension after deployment: operational evidence may re-veal not only that the system must change, but that the development process that produced it is itself incomplete. Existing ML lifecycle and MLOps approaches close parts of this feedback loop through monitoring, retraining, testing, and redeployment, yet provide limited support for reasoning about such evidence against an explicit process structure spanning software, data, and ML development. We investigate this operation-to-development boundary through AI-assisted dental CAD/CAM, where learned crown geometry subsequently encounters expert, geometric, and manufacturing constraints. Using a literature-grounded reconstruction, we instantiate the development dependencies of a patient-specific crown-generation capability in AIEngOrchestrator, a model-driven framework for coordinating software, data, and ML development. The case exposes two fundamentally different responses to operational evidence: the evidence may be propagated through dependencies already represented in the process, requiring development change within the existing process model; or it may expose a missing dependency, indicating that the process model itself must evolve. Based on this distinction, we extend AIEngOrchestrator with an explicit operation-to-development feedback mechanism that introduces operational evidence into process reasoning and distinguishes change within a development process from change to the process itself. Representative evolution scenarios demonstrate how this distinction enables traceable reasoning from downstream evidence to software, data, and ML development concerns. The resulting perspective connects classical software-process evolution with production-aware AI engineering: the deployed product becomes not only an outcome of development, but also a source of evidence about the adequacy of the process that produced it.

ES5017 (14:00-14:15 GMT+9)

A Three-Level Reasoning Architecture for Identifying Command-Line Interfaces in GitHub Repositories

Davide Evangelista¹, Mathieu Linty², **Andrei Mikriukov**^{2,3}, Alessandro Ravveduto², Mariia Snigireva^{2,3}, Giancarlo Succi^{2,3}, and Alexander Tormasov^{2,3}

1: University of Bologna, Italy

2: Constructor Labs, Bremen, Germany

3: Constructor University, Bremen, Germany

Abstract—This paper proposes a three-level reasoning architecture for identifying command-line interfaces in GitHub repositories. The problem is relevant for automated execution, empirical software engineering, and computational reproducibility, because repositories often contain several executable scripts, incomplete documentation, test utilities, notebooks, package modules, and input requirements that are not stated in one place. The proposed architecture combines propositional logic, Horn clauses, and large language models. The propositional level records local facts, such as the existence of a file, the presence of a main guard, the occurrence of a timeout, or the availability of command-line help. The Horn-clause level relates files, imports, documentation fragments, help messages, candidate resources, and runtime failures. The large language model level is used only when the symbolic layers leave a question unresolved or when natural language must be interpreted. The paper describes the problem, the evidence model, the rule base, the execution cycle, the role of SWI-Prolog, the relation with Python-only and Datalog alternatives, and an evaluation plan. The architecture is generic and does not depend on a specific platform.

ES5014 (14:15-14:30 GMT+9)

An Automated Robotic System for Reproducing Line-Art Drawings Using Computer Vision, Skeleton Tracing, and Closed-Form Inverse Kinematics

Yicheng Fan, Yu Sun and Ang Li

1: Newton North High School, United States

2: California State Polytechnic University, Pomona, United States

3: Cal State Long Beach, United States

Abstract—Reproducing an arbitrary drawing on paper requires solving three problems that are individually well studied but difficult to integrate on low-cost hardware: interpreting visual data, planning an efficient sequence of pen strokes, and controlling a mechanism accurately in physical space. This paper presents a complete, inexpensive

drawing robot that converts a raster line-art image into physical pen strokes using a two-motor five-bar parallel linkage. A computer-vision front end binarizes the input with Otsu thresholding, thins it to a one-pixel skeleton using the Zhang–Suen algorithm, traces the skeleton as a graph to extract discrete strokes, simplifies each stroke with the Douglas–Peucker algorithm, and re-orders the strokes with a greedy nearest-neighbour heuristic. A control back end scales the strokes into the arm’s millimetre workspace, solves the closed-form inverse kinematics of the 130 mm five-bar linkage while rejecting unreachable points before any motion occurs, and streams synchronized position commands to two brushless servo actuators over a CAN bus. A browser-based web interface complements the pipeline: it simulates the arm as a digital twin—reproducing its kinematics, calibration, servo limits, and measured stiction—runs the vision pipeline in-browser, and drives the physical arm through a local telemetry-and-command bridge. Experimental evaluation shows that stroke simplification preserves line geometry to within a mean deviation of 0.014 pixels at the chosen operating tolerance, and that nearest-neighbour ordering reduces unproductive pen-up travel by 99.1%, from approximately 427,900 pixels to 4,060 pixels. The complete system runs on a laptop with hobby-grade hardware, demonstrating that faithful image-to-pen reproduction is achievable with transparent, classical algorithms at a small fraction of the cost of commercial plotting systems.

ES5009 (14:30-14:45 GMT+9)

A protocol for event dispatching and transition priority policies in a UML state machine
Constantinos Constantinides, Ali Jannatpour and **Vinisha Manek**
Concordia University, Canada

Abstract—In the context of State Machines in the UML Specification, the event pool is an abstraction that stores pending events. The Specification intentionally leaves unspecified the nature of the pool, as different systems would require different types, such as FIFO queues, priority queues, etc. Events are taken from the pool one at a time. The specification leaves several aspects undefined or open to interpretation. Of particular interest to this study is a) the organization of the event pool and b) handling of events, particularly dispatch rules and priority policies.

Note

Note

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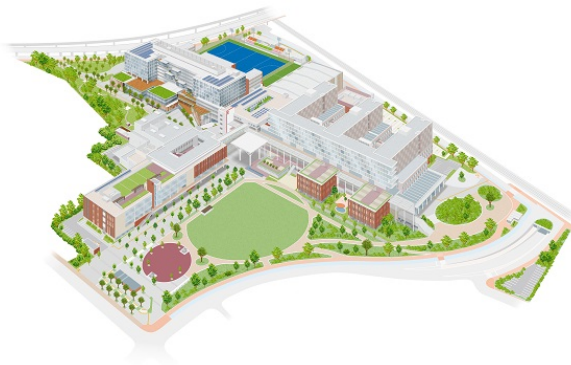
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